DOCUMENT RESUME

ED 174 074 HE 011 413

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TITLE Marginal Funding: A Difference That Makes a Difference? AIR Forum 1979 Paper.
PUB DATE May 79
NOTE 29p.; Paper presented at the Annual Forum of the Association for Institutional Research (19th, San Diego, California, May 13-17, 1979)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Budgeting; *College Planning; *Educational Economics; Educational Finance; Enrollment Trends; Higher Education; *Resource Allocations; Retrenchment; State Aid; *Statewide Planning
IDENTIFIERS *AIR Forum 1979; *Marginal Funding; Minnesota University

ABSTRACT

A model that allows for the assessment of alternative funding formulas for postsecondary educational systems is described. The need for a practical planning model to fit the changing context of higher education funding is emphasized. The importance of a relatively simple funding model that will allow consideration of the aggregate impact of changing basic variables is also discussed. Various components of the proposed model are described. The model is designed to consider alternative funding formulas such as marginal funding, where ratios and compensation rates vary by the magnitude of the projected enrollment changes. The application of the model to a study of Minnesota higher education is described. From results of the study based on the practical planning model, it is concluded that some form of marginal resource allocation may serve to benefit both the state and higher education in a period of declining enrollments. While the model operates at a statewide level of aggregation, it is suggested that it would also be beneficial to those interested in system and institutional resource allocation patterns. (Author/SF)

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ED174074

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Nineteenth Annual Forum of the Association for Institutional Research held at the Town and Country Inn in San Diego, California, May 13-17, 1979. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC collection of Forum papers.

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HE 011 413

MARGINAL FUNDING:

A DIFFERENCE THAT MAKES A DIFFERENCE?

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MARGINAL FUNDING: A DIFFERENCE THAT MAKES A DIFFERENCE?

ABSTRACT

This paper describes a model which allows for the assessment of alternative funding formulas for post-secondary educational systems. The first sections of the paper present a rationale and identify the characteristics of what the authors label a "practical planning model." The remainder of the paper describes the model and shows its application to a specific situation. The emphasis is on assessing the extent to which marginal funding proposals can offer a viable alternative to traditional linear enrollment driven formulas. While the model operates at a statewide level of aggregation, it should also be beneficial to those interested in system and institutional resource allocation patterns in a period of declining enrollments.

MARGINAL FUNDING: A DIFFERENCE THAT MAKES A DIFFERENCE?

Introduction

As higher education prepares to enter the 1980s, it does so with considerable trepidation. Public bodies are demanding increasing accountability; the traditional pool of potential college students is expected to decrease dramatically; funding, particularly from state legislatures, must be justified in more detail than ever before; and there are many other high priorities for state funds. It is with the issue of funding higher education in a decade of enrollment decline that this paper is concerned.

The intent of this paper is twofold. First, to argue that with respect to statewide appropriation decisions in public higher education that, to some extent, a simpler approach might be useful in presenting the case for institutional and systemwide resource demands. Second, to present a model which addresses some of the concerns with respect to simplicity and use, showing its application in a specific situation. These two themes, the need to re-examine the relationship between public higher education and the legislature with respect to funding and the description of a specific model, can be considered separately. The authors, however, feel that the development of the model owes much to their (and others') observations with respect to the changing context of higher education.

The Political Context and the Need for a Practical Planning Model

The consideration of any planning model should commence with an identification of the audience to which it is to be directed and the type of decisions which it is designed to inform.

Traditionally, funding formulas of various types have been used to help simplify the appropriation decisions facing a legislature. Although these formulas vary in technical sophistication, the state appropriations decisions they inform tend to be made in a lump sum or highly aggregated fashion (Gross, 1973). Relatively simple enrollment driven formulas appeared to benefit higher education when it was in a period of expansion. However, there is serious question as to the adequacy of these formulas as higher education faces a period of enrollment stability and decline.

Throughout the 1970s, more sophisticated funding models have been developed. Higher education planners have become increasingly concerned with the complexity of higher education financing and have developed models to examine this complexity. Some have been integrated into the funding process while others have not. Many of the models, particularly those concerned with institutional cost behavior, are extremely complex, sophisticated, and costly to operate (Adams, Hankins, Schroeder, 1978). These models are, in a sense, developed by the analyst for the analyst, with little attention paid to the needs of an external user.

These models may be quite appropriate for decision-makers within an institutional context; i.e., presidents, vice-presidents and deans; who are concerned with internal resource allocation and managerial decisions. Yet, there is some question as to whether it is the appropriate focus for dealing with an external constituency such as a state legislature.

This point was made by Robert K. Thompson of the University of Washington when, in commenting on the Washington statewide costing study, he said:

> It is too complex. State decision-makers in the executive and legislative branch need to work with programs

> and concepts at a simplistic and aggregate level in order to place those decisions in a statewide context that is workable. Legislators and governors do not have the time and interest to work with details and complexities, they require and need simple and straightforward approaches to their decision problems (1979).

The state legislature is the body charged with determining an overall resource allocation to public higher educational institutions or systems. These legislators are external to the educational environment and subject to a differing set of pressures and constituencies than the institutional administrator. It may be that information appropriate to one may not be appropriate to the other.

What are some of the characteristics of state legislators which provide constraints on their use and appreciation of technical information? Nichols (1976) identifies three:

> First, many legislators are part-time and thus have various demands on their time from outside as well as inside the legislature.
>
> Second, state legislators have diversified backgrounds. Few have training in traditional scientific and technical areas.
>
> Third, state legislators traditionally serve for short periods of time. Most legislatures see a 40-70% turnover per term with a term of office being only two years.

When these factors are coupled with the competing funding demands made by various public agencies, it is little wonder that state legislators seldom

have the time or inclination to become immersed in the complexities of financing higher education.

The above is not to argue that technical analysis of higher education is unnecessary or unimportant. It is simply to note that the use of the resulting models and modes of analysis to assist in legislative funding decisions may be inappropriate.

If the above observations are accurate, higher education is faced with a dilemma. It has successfully convinced state legislatures that linear funding formulas were appropriate when enrollments were expanding. But now, faced with declining enrollments, it must convince the legislatures not to expect funding to decrease in a similar manner. What are offered as alternatives are more complex approaches to funding which may require a legislator to take on "faith" the results of the analysis. With these new funding proposals, the resource requirements generated also may be in sharp contrast with legislative expectations, given the previous emphasis on enrollment driven funding.

The Model

Based on the preceeding considerations, it appears there is a need for a practical financial planning model which has as its intended audience state legislators concerned with the funding of public higher education. In developing such a model, there are several characteristics which are desirable. The foremost among these are:

1. The primary variables in the model should be those, or variations of those, which the legislature currently considers relevant in making its appropriations decisions. This represents a sensitivity to the incremental decision-

making of most legislatures and recognizes that it is unlikely they will readily alter what they perceive as having served them well in the past.

2. The model should reflect the level of aggregation at which legislative financing decisions are made. For better or worse, decisions regarding funding and staffing are made at relatively high levels of aggregation which obscure the internal issues of resource allocation and management. With respect to the base, these latter decisions appear to legislators as being the appropriate concern of institutional administrators.
3. The model should be simple. The simulated relationships should be quite transparent and the quantity of variables and volume of output should be kept at a minimum.
4. The model should have clearly evident assumptions. This allows for disagreement over the model's assumptions to be distinct from debate over substantive issues.
5. The model should have the capability to easily perform alternative simulations. This flexibility allows for a variety of options to be considered within the time constraints usually present in legislative decisions.

As the desired characteristics of a practical planning model indicate, it is not designed to be a research vehicle to explain financial behavior and relationships, but a practical calculator to easily allow consideration of the aggregate impact of changing basic variables.

Given the general characteristics of a practical planning model, there are also substantive characteristics of the model which need to be

identified so that it reflects the conditions of the state in which it is being used. Among the substantive characteristics which were deemed important for inclusion in a model for the situation in Minnesota were:

1. The basic components of the model must be enrollment driven. There appears to be an expectation on the part of Minnesota legislators that changes in appropriations requests should somehow be related to changes in enrollments.
2. The model should reflect, at least in a general fashion, fixed and variable costs facing an institution or system. This permits the integration of a marginal funding component within the model to allow for the differential addition and reduction of resources.
3. The primary focus of the model should be on the "base" component of appropriations.[1] Special appropriations, quality adjustments, etc. should be handled on an individual basis.
4. The model's output should first be presented in constant dollars so as to show the "real" impact of simulated changes. Inflationary adjustments and allowances for other increases can be added as needed.

The Minnesota model was designed with the State Planning System (SPS) software package developed by the National Center for Higher Educational Management Systems (NCHEMS). The documentation for the SPS software is contained in Technical Reports 86-97 (NCHEMS, 1977). A detailed description of the model will not be provided here as it is discussed more fully

and documented in Monical, 1978. However, it is important to briefly review the general components of the model.

The calculation component of the model is quite simple. Projected enrollment times a staffing ratio equal a projected personnel complement. The personnel complement times an individual compensation rate yields total personnel compensation. Projected enrollment times non-personnel expenditures per student result in total non-personnel expenditures.

To this point, the model very closely reflects the approach taken by past legislatures in determining base level appropriations for the higher educational systems in Minnesota. The model, however, has the ability to simulate these relationships under different sets of assumptions and with different input values. Herein lies its utility in planning for the 1980s.

The basic input values; staffing ratios, compensation rates and non-personnel expenditures per student; can be differentiated along the following lines. Different staffing ratios and compensation rates can be employed for both unclassified and classified personnel. Further, all inputs vary also across two general program categories; instruction and departmental research (IDR) and institutional support (SUPT). The result is that the two original personnel related equations take on eight sets of initial values depending on whether they are for classified or unclassified personnel in either IDR or SUPT. Non-personnel expenditures per student vary by program, IDR or SUPT. With initial values and enrollments, the ten equations generate data on the system staff levels and expenditures.

If the model was designed soley to address linear funding based on enrollment changes, the above would be sufficient. The model, however, is designed to consider alternative funding formulas. In this specific case, it is used to analyze the impact of marginal funding formulas, where ratios

and compensation rates vary by the magnitude of the projected enrollment changes.

The model has the capacity to segment changes in enrollment from a user specified base into three marginal enrollment components. The sizes of the marginal components are also specified by the users. Thus, for a given base enrollment, the user decides on up to three components of marginal enrollment change. The input variables for the basic equations; staffing ratios, compensation rates and non-personnel expenditures per student; can then be varied for each of the three marginal enrollment components and can be varied independently for increases and decreases. The ten basic equations can have different input values for each of the three marginal decrease levels. This constitutes the marginal funding component of the model.

The ten equations which generate the base can have their values varied within each of the six enrollment margins (three increments, three decrements) and the values chosen represent the policy decisions of the users and the impact of these values is simulated. A further area of policy control and variation in simulation is in the size of the enrollment base and margins. Thus, if the user wishes to consider another policy option, all that is necessary is to change the values of the variable in question in order to assess the simulated impact.

Before turning to an application of the model, it is appropriate to note what the model is not. It does not attempt to simulate cost behavior, rather, it simulates alternative impacts of changing the values of variables which policy-makers generally see as being somewhat under their control--staffing levels and compensation rates. It is not a research oriented model to explain behavior, but a policy oriented model to

simulate "what would happen if?" Finally, the model does not address the allocation of resources within institutions, rather, it focuses on system-wide aggregate funding levels of legislative concern; i.e., "the bottom line."

Application

The projected enrollment context facing Minnesota higher education is displayed in Figure 1. Each of the three collegiate systems will experience some growth through the early 1980s followed by decline in the remaining years of the decade. Full year equivalent (FYE) enrollment levels are projected to peak in 1982 for the community colleges at about 3.0% higher than 1978 levels (MHECB, 1978). Both the State University System and the University of Minnesota are expected to peak in 1983, 3.2% and 4.7% respectively. By 1990, enrollments are anticipated to be 12.0% under the 1978 level for the community colleges, 16.3% under for the state universities and 14.2% under for the University of Minnesota. It is to this projected enrollment context that the model was applied. Initially, the model was applied to all four public post-secondary educational systems in Minnesota. However, because of special circumstances with regard to the Area Vocational-Technical Institutes and the University of Minnesota, the discussion will focus on the Community College System and the State University System.[2]

The initial conditions for the base level expenditure generation are contained in Table 1. These equations generate the 1978 patterns of staffing and expenditures for each of the two systems across all alternative simulations. Table 2 identifies those input variables which will take on different values in each increment and decrement. As can be seen

FIGURE 1

PROJECTED ENROLLMENTS IN MINNESOTA

1978 TO 1990

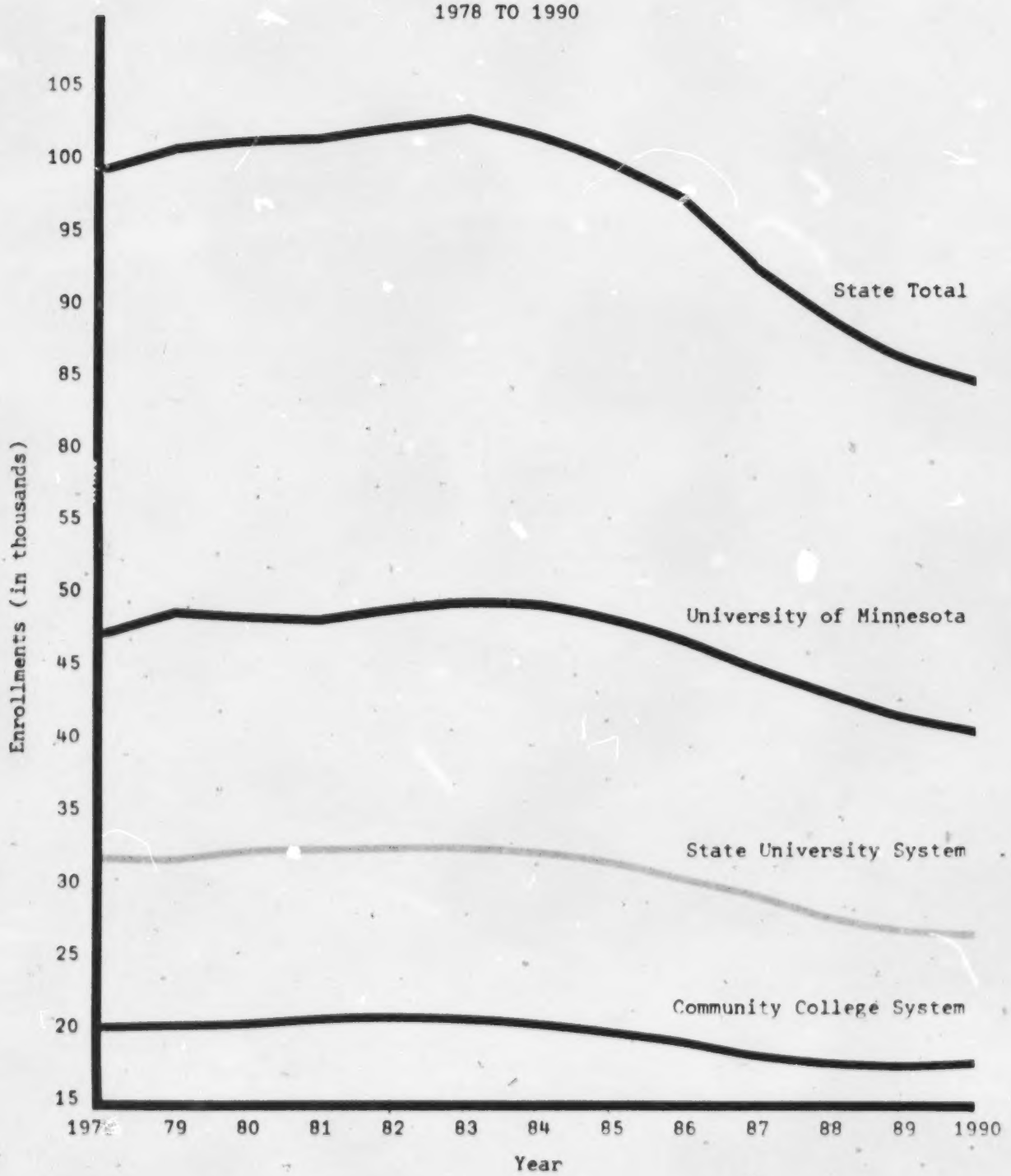

TABLE 1

INITIAL CONDITIONS:

STATE UNIVERSITY SYSTEM AND

COMMUNITY COLLEGE SYSTEM

Variable	SUS Value	CCS Value
IDR Classified Staffing Ratio	178:1	863:1
IDR Unclassified Staffing Ratio	17:1	21:1
IDR Classified Compensation Rate	$12,424	$10,737
IDR Unclassified Compensation Rate	$21,403	$18,287
IDR Non-Personnel Expenditure Per FYE	$176	$65
SUPT Classified Staffing Ratio	26:1	39:1
SUPT Unclassified Staffing Ratio	76:1	63:1
SUPT Classified Compensation Rate	$13,186	$12,208
SUPT Unclassified Compensation Rate	$24,870	$24,314
SUPT Non-Personnel Expenditures Per FYE	$883	$587

TABLE 2

INPUT VARIABLES SUBJECT TO

MARGINAL CHANGES

Increment/Decrement 1

IDR Unclassified Staffing Ratio
IDR Unclassified Compensation Rate
IDR Non-Personnel Expenditures Per FYE
SUPT Non-Personnel Expenditures Per FYE

Increment/Decrement 2

IDR Unclassified Staffing Ratio
IDR Classified Staffing Ratio
IDR Unclassified Compensation Rate
IDR Classified Compensation Rate
IDR Non-Personnel Expenditures Per FYE
SUPT Classified Staffing Ratio
SUPT Classified Compensation Rate
SUPT Non-Personnel Expenditures Per FYE

Increment/Decrement 3

IDR Unclassified Staffing Ratio
IDR Classified Staffing Ratio
IDR Unclassified Compensation Rate
IDR Classified Compensation Rate
IDR Non-Personnel Expenditures Per FYE
SUPT Unclassified Staffing Ratio
SUPT Classified Staffing Ratio
SUPT Unclassified Compensation Rate
SUPT Classified Compensation Rate
SUPT Non-Personnel Expenditures Per FYE

in Table 2, only faculty positions and non-personnel expenditures vary in the first increment/decrement. In the second increment/decrement, all the components of IDR vary as well as classified support personnel and SUPT non-personnel expenditures. Finally, in the third increment/decrement, all inputs are allowed to vary. The decision to allow these particular variables to vary was the researchers'. There is nothing preventing simulations using alternative variable sets.

Simulations were also performed using different compensation rates. In one set of simulations, mean compensation rates for each personnel classification were used. In another, entry or low level compensation rates were applied. This allowed assessment of the impact of adding and deleting staff at average or entry compensation rates.

The amount of resources added and deleted within each increment were varied for four different runs, two symetrical (resource changes in increments and decrements identical) and two asymetrical (resource changes different in increments and decrements). Table 3 displays the amount of variation in input variables for each of the runs. The rate adjustments to base level resource input are interpreted as follows: If a system is staffed at 20 FYE to 1 faculty in the base, then a .50 rate adjustment means it will add or reduce faculty at one-half the normal rate, or 40:1. Non-personnel expenditures per student will also be adjusted at 50% of the base level. When the rate adjustment is .25, then, using the above example, it would take an adjustment of 80 students to generate an adjustment of 1 faculty. Applying the adjustment rates in Table 3 to the initial conditions in Table 1 will provide the values for the variable sets in Table 2 for each increment/decrement simulated.

TABLE 3

ADJUSTMENT RATES FOR

BASE LEVEL RESOURCE INPUTS

Run Number	Compensation Level	Incr. 1	Incr. 2	Incr. 3	Decr. 1	Decr. 2	Decr. 3
1	Mean	NO INCREMENTAL ANALYSIS					
(Symetrical)							
2	Mean	.50	.50	1.00	.50	.50	1.00
3	Low	.50	.50	1.00	.50	.50	1.00
4	Mean	.25	.25	.50	.25	.25	.50
5	Low	.25	.25	.50	.25	.25	.50
(Asymetrical)							
6	Mean	.50	.50	1.00	.25	.25	.50
7	Low	.50	.50	1.00	.25	.25	.50
8	Mean	.50	.50	1.00	.25	.50	1.00
9	Low	.50	.50	1.00	.25	.50	1.00

Results

Tables 4 and 5 present selected output from the simulation runs for the community colleges and state universities respectively.[3] The size of increment/decrement one is 3% of the base enrollment, for increment/decrement two 5% of the base, and the third increment/decrement is over 8% of the base. The first set of runs contained no marginal analysis. It demonstrates the consequences of adhering to strict linear funding as expenditures and staff will vary by the same percent as enrollment. All simulations were in constant 1978 dollars. An inflation or real adjustment rate can be added as policy option. Detailed breakdowns for output by IDR and SUPT, classified and unclassified, as well as staffing ratios can also be provided by the model. For purposes of this paper, only total expenditures, expenditures per student, and unclassified positions for the entire system are highlighted.

Table 6 shows the percent changes in selected characteristics across the five runs between the base year and 1990. Because of the margins and rate adjustment changes in unclassified personnel, percent changes are the same for Runs 2 and 3 and 4 and 5 respectively. In addition, when average personnel compensation is used, adjustments in expenditures will be identical to adjustments in staffing.

The policy impact of marginal funding alternatives can be seen, however, when one compares the difference between linear funding with any of the marginal options. Over the projected period of decline, systems will require fewer resources, but more than would be allocated under linear formulas. This difference can provide a negotiation area where the needs of the system and the constraints in state resources can be more closely examined.

TABLE 4

SELECTED CHARACTERISTICS

COMMUNITY COLLEGE SYSTEM

Total Expenditures*

Run No.	1978	1980	1982	1984	1986	1988	1990
1	$44.97	$45.36	$46.30	$45.36	$42.43	$39.69	$39.58
2	44.97	45.10	45.43	45.10	44.02	41.90	41.79
3	44.97	45.08	45.35	45.08	44.20	42.52	42.44
4	44.97	45.04	45.20	45.04	44.50	43.43	43.38
5	44.97	45.03	45.16	45.03	44.58	43.75	43.71

Expenditures Per Student

1	$2,219	$2,219	$2,219	$2,219	$2,219	$2,219	$2,219
2	2,219	2,206	2,177	2,206	2,302	2,342	2,343
3	2,219	2,205	2,173	2,205	2,311	2,377	2,379
4	2,219	2,203	2,166	2,203	2,327	2,428	2,436
5	2,219	2,203	2,164	2,203	2,331	2,446	2,450

Unclassified Positions

1	1,272	1,283	1,310	1,283	1,200	1,123	1,120
2	1,272	1,276	1,286	1,276	1,245	1,186	1,183
4	1,272	1,274	1,279	1,274	1,259	1,229	1,228

*In millions.

TABLE 5

SELECTED CHARACTERISTICS

STATE UNIVERSITY SYSTEM

Total Expenditures*

Run No.	1978	1980	1982	1984	1986	1988	1990
1	$101.43	$103.62	$104.21	$103.46	$ 97.41	$88.98	$84.93
2	101.43	102.22	102.43	102.16	99.89	93.72	89.67
3	101.43	102.09	102.27	102.04	100.15	95.20	93.11
4	101.43	101.82	101.93	101.79	100.66	97.57	95.55
5	101.43	101.76	101.85	101.73	100.79	98.31	96.69

Expenditures Per Student

1	$3,203	$3,203	$3,203	$3,203	$3,203	$3,203	$3,203
2	3,203	3,160	3,148	3,163	3,285	3,374	3,382
3	3,203	3,156	3,143	3,159	3,293	3,427	3,468
4	3,203	3,147	3,133	3,151	3,310	3,512	3,603
5	3,203	3,145	3,130	3,150	3,314	3,539	3,647

Unclassified Positions

1	2,269	2,318	2,331	2,314	2,179	1,990	1,900
2	2,269	2,289	2,294	2,287	2,232	2,098	2,007
4	2,269	2,279	2,281	2,278	2,250	2,183	2,138

*In millions.

TABLE 6

PERCENT CHANGES IN SELECTED CHARACTERISTICS

FROM BASE YEAR TO 1990

Community College System

Run No.	Total Expenditures	Expenditures Per FYE	Unclassified Personnel
1	-12.0%	-	-12.0%
2	-7.1	+5.6%	-7.0
3	-5.6	+7.2	-7.0
4	-3.5	+9.8	-3.5
5	-2.8	+10.4	-3.5

State University System

1	-16.3%	-	-16.3%
2	-11.6	+5.6%	-11.5
3	-8.2	+8.3	-11.5
4	-5.8	+12.5	-5.8
5	-4.7	+13.9	-5.8

Observations

In discussing a model of this type, a detailed numerical analysis of the output does not appear to be as appropriate as a consideration of the relationships which the model illuminates. The specific projections will vary from situation to situation, but the implications of those projections will remain constant. Some of the following observations may appear obvious to educational researchers, but for the type of audience for whom the model is intended, they may not be so apparent.

1. Marginal funding formulas are sensitive to enrollment changes, but not as sensitive as linear funding formulas. The closer the base adjustment rate is to the base input levels, the closer the simulations are to linear.
2. Under all marginal simulations, fewer resources will be added and fewer reduced than with linear funding. As enrollment increases, resources will be added at a marginal rate. As enrollment decreases, they will be withdrawn at a marginal rate. The net effect is to "flatten" the resource requirement curve during a period of enrollment fluctuation.
3. With respect to the base year, marginal funding will bring in more total dollars and lower dollars per student in periods of enrollment growth and fewer total dollars and higher dollars per student in periods of enrollment decline. There can be an overall lowering of appropriations even though the appropriation per student will be undergoing a "real" increase over the base.

4. Using marginal staffing ratios reduces large fluctuations in the size of the staffing component resulting from sharp enrollment increases and decreases. This could allow systems some flexibility in reassignment of faculty to meet internal shifts in student demand patterns.
5. The incremental funding and staffing levels used in the analysis runs represent "negotiated" or "political" decisions as to the size of the margins. While most will agree that there are marginal costs associated with the provision of higher educational services, at the present time there is little empirical data as to what they actually are. When such data become available, they easily could be incorporated into the model. Until it is available, showing the impact of alternative marginal approaches may serve an important function.
6. The use of marginal funding without periodic re-examination of base enrollments only results in a slower rate of decline than simple linear funding. In the context of long-term enrollment declines, periodic re-establishment (lowering) of the enrollment base provides the systems with step-wise funding reductions.

Areas of Further Research

Application of the model suggests several areas for further research which can result in both a "fine tuning" of the model itself and in output which more closely reflects the actual situation of the system(s) in question. Among these areas are:

1. Applying the model to more discrete units within a system or institution. There is no conceptual problem associated with attempts to simulate the impact of marginal funding on more discrete units, such as individual institutions or programs. Constraints on this type of application should be the types of decisions which the intended users are to make.
2. More complete specification of fixed, semi-fixed and variable costs. As more research becomes available on actual cost behavior patterns with institutions and systems, this information could be used to modify the functional relationships in the model. It may be that certain types of costs should remain completely fixed across all levels of enrollment fluctuation, while others should be made more sensitive to enrollment changes.
3. Empirical data on marginal cost and staffing ratios. Availability of this type of information could alter the functional form of the model, but may also lead to a better understanding of what the appropriate enrollment margins should be and what the rate of allocation of resources should be with the enrollment margins.
4. Studies of faculty/staff attrition and tenure. Empirical analysis of these factors could lead to an independent assessment of the degree of flexibility in staffing resources which will be available in a period of enrollment decline. With this type of information, it would

not be difficult to design alternatives which more closely take into account the actual number of positions which would be available for retrenchment in a given year.

5. Minimum staffing and resource requirements necessary to sustain the goals and missions of a specific system or institution. As empirical data becomes available as to the "minimum core" of an institution, it can be used to determine the point at which no further reductions in resources can be made without impairing the mission of the institution. Information in this area could be helpful in establishing a new or revised base level of resources.

Conclusion

Marginal funding makes a difference. If the experience of this model is any indication, some form or marginal resource allocation may serve to benefit both the state and higher education in a period of declining enrollments. It will benefit the state because there will be some real level of resource reduction due to enrollment declines. It will benefit higher education because the rate of reduction will be less than it would be if linearly related to enrollments. Further, the use of a relatively simple model for marginal funding may be of benefit to all as it allows for a clear focus on the potential impact of decisions made by state policy-makers. By using this type of approach for issues dealing with base level funding requirements, it also allows systems and state policy-makers to focus attention on other aspects of higher education funding which may need individual consideration. While this specific model (or

some varient) may not be the appropriate vehicle, failure to recognize the challenges posed by the projected enrollment patterns of the 1980s and the promise offered by some type of marginal funding approach could truly make the 1980s a decade of decline for higher education.

FOOTNOTES

[1]In Minnesota and other states, a distinction is made between all enrollment related expenditures (i.e., the base) and items such as salary adjustments, program improvements, etc. What constitutes the base is generally determined by past practice.

[2]Detailed information on all systems and on runs not discussed below are available from MHECB.

[3]Output on the asymetrical runs (6-9) are not displayed as they can be extrapolated by observing the rate adjustments in Table 3 and extracting the appropriate entry from Tables 4 and 5. For example, Run 6 would consist of the first 3 columns of Run 2 and the last 3 columns of Run 4.

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